

Agricultural Power and Equipment

Agricultural Power and Equipment includes basic information and laboratory activities on small engines, tractors and agricultural equipment maintenance, repair and overhaul. The standards address competencies for electrical motors, hydraulic systems and fuel-powered engines.

Pre-requisites: Any course in the agricultural mechanics sub-cluster

Recommended Credit: 1 or 2

Recommended Grade Levels: 11th, 12th

*** 1 denotes learning expectations that must be met when teaching the course for the 1st credit.**

**** All other learning expectations must be met when teaching the course for the 2nd credit.**

Agricultural Power and Equipment

Standard 1.0

The student will demonstrate the safe use of agricultural tools and equipment.

Standard 2.0

The student will summarize the theory of engine operation.

Standard 3.0

The student will demonstrate the basic operation of agricultural machinery.

Standard 4.0

The student will demonstrate the correct use of precision instruments and basic tools to make settings on agricultural power equipment and small engines to manufacturer's specifications.

Standard 5.0

The student will utilize trouble-shooting techniques to assess engine failure problems.

Standard 6.0

The student will relate engine components to various systems.

Standard 7.0

The student will read and interpret diagrams and schematics related to agricultural equipment.

Standard 8.0

The student will compare the characteristics and uses for a variety of fuels and lubricants.

Standard 9.0

The student will demonstrate electrical motor operation, maintenance, and application.

Standard 10.0

The student will evaluate career opportunities available in agriculture power and equipment.

Standard 11.0

The student will integrate academic competencies in agricultural power and equipment.

Standard 12.0

The student will develop premier leadership and personal growth needed for success and advancement in the career area of agricultural mechanics.

Course Description:

This course will include basic information and laboratory activities on small engines, tractors, and agricultural equipment maintenance, repair and overhaul. The standards address competencies for electrical motors, hydraulic systems and fuel-powered engines.

Standard 1.0

The student will demonstrate the safe use of agricultural tools and equipment.

Learning Expectations:

The student will:

- | | | |
|-----|------------------------------------------------------------------------------------------------------------------------|----------|
| 1.1 | Demonstrate the safe use of shop tools and equipment. | 1 |
| 1.2 | Specify the safety color codes used in a shop environment. | 1 |
| 1.3 | Differentiate the classes of fire and correlate with the appropriate fire extinguishers needed for each class of fire. | 1 |
| 1.4 | Determine safety procedures to be used in a shop environment. | 1 |

Evidence Standard is Met:

The student will:

- Complete a shop safety test with 100 percent accuracy.
- Complete a tool identification test.
- Prepare a student/teacher safety agreement contract.

Integration/Linkages

Language Arts, OSHA Standards, TOSHA Standards, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Recommend correct fire extinguishers for the appropriate class of fire.
- Relate correct colors with safety codes.
- Organize tools by appropriate name and use.
- Have safety agreement signed by student and student's guardian(s).

Standard 2.0

The student will summarize the theory of engine operation.

Learning Expectations:

The student will:

- | | | |
|-----|-------------------------------------------------------------------------------|----------|
| 2.1 | Distinguish between a motor and engine. | 1 |
| 2.2 | Summarize the four-stroke cycle and the events that occur during each stroke. | 1 |
| 2.3 | Specify the basic engine parts involved in the four-stroke cycle. | 1 |
| 2.4 | Summarize the two-stroke cycle and the events that occur during each stroke. | 1 |
| 2.5 | Specify the basic engine parts involved in the two-stroke cycle. | 1 |
| 2.6 | Distinguish between gasoline and diesel engines. | 1 |

Evidence Standard is Met:

The student will:

- Specify on a lab engine each of the strokes and their purposes.
- Demonstrate knowledge of basic engine nomenclature, during disassembly and assembly of an engine.
- Describe reaction differences in gasoline and diesel engines.

Integration Linkages

Mathematics, Physics, Language Arts, TOSHA Standards, OSHA Standards, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Summarize different strokes on lab engines.

- Summarize engine parts and their functions on a lab engine.

Standard 3.0

The student will demonstrate the basic operation of agricultural machinery.

Learning Expectations:

The student will:

- 3.1 Demonstrate routine maintenance procedures.
- 3.2 Demonstrate functions of various agricultural equipment.
- 3.3 Recommend hitch systems used on agricultural equipment.

Evidence Standard is Met:

The student will:

- Perform routine maintenance on various agricultural equipment.
- Recommend repairs for various agricultural equipment.
- Summarize various types of hitch systems used on agricultural equipment.

Integration Linkages

Physics, Mathematics, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Perform maintenance from one or more of the following assigned lab equipment.
 - Tractor
 - Combine
 - Hay Equipment
 - Silage Cutter
 - Cotton Picker
 - Tobacco Setter
 - Planter (conventional or no-till)
- Relate hitch systems with appropriate equipment and use.
- Select equipment needed for a variety of agricultural tasks.

Standard 4.0

The student will demonstrate the correct use of precision instruments and basic tools to make settings on agricultural power equipment and small engines to manufacturer's specifications.

Learning Expectations:

The student will:

- 4.1 Demonstrate a knowledge of tools used in making precision instruments. **1**
- 4.2 Record and interpret data from precision measurements. **1**
- 4.3 Demonstrate safe use of precision tools and equipment. **1**

Evidence Standard is Met:

The student will:

- Using precision instruments, calculate measurements on small engine equipment.
- Use precision measurements to make necessary adjustments to agricultural machinery.

Integration Linkages

Mathematics, Science, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills), Small Engine Industry Specifications, Agricultural Equipment Specifications

Sample Performance Tasks

- Perform the following measurements on lab engines or equipment:
 - Cylinder Diameter
 - Spark Plug Gap
 - Piston Ring Clearance

- Crankshaft Journal Diameter
- Valve Tappet Clearance
- Valve Margin
- Specify repairs or maintenance needed based on measurements.

Standard 5.0

The student will utilize trouble-shooting techniques to assess engine failure problems.

Learning Expectations:

The student will:

- | | | |
|-----|---------------------------------------------|----------|
| 5.1 | Diagnose common engine problems. | 1 |
| 5.2 | Categorize major causes of engine failures. | 1 |

Evidence the Standard is Met:

The student will:

- Troubleshoot problems in lab engines.
- Determine causes of failures in lab engines.

Integration Linkages

Physics, Mathematics, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills), Small Engine Industry Specifications

Sample Performance Tasks

- Determine the causes of engine failures in sabotaged lab engines.
- Demonstrate failures that could develop in an engine.
- Create a chart matching common engine failures with the appropriate engine system.

Standard 6.0

The student will relate engine components to various systems.

Learning Expectations:

The student will:

- | | |
|-----|----------------------------------------------------------------|
| 6.1 | Differentiate the parts and the purpose of each engine system. |
| 6.2 | Specify the components and functions of hydraulic systems. |

Evidence the Standard is Met:

The student will:

- Categorize the various parts of each system with proper nomenclature.
- Explain the function of the various parts of each system.
- Diagram the parts and functions of a hydraulic system.

Integration Linkages

Mathematics, Physics, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Compare each part of an engine with its function.
- Critique systems associated with each system failure.
- Prepare a chart that describes how the parts of an engine affect the operational systems of the engine.

Standard 7.0

The student will read and interpret diagrams and schematics related to agricultural equipment.

Learning Expectations:

The student will:

- | | |
|-----|-------------------------------------------------|
| 7.1 | Read and interpret hydraulic system schematics. |
| 7.2 | Read and interpret electrical schematics. |

Evidence Standard is Met:

The student will:

- Diagram the direction of oil flow in hydraulic systems.
- Sketch and label an electrical schematic, showing the flow of power through the system.

Integration Linkages

Art, Mathematics, Science, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills), Electronics

Sample Performance Tasks

- Map the directions of oil flow in hydraulic systems.
- Wire a lab engine according to electrical schematics.

Standard 8.0

The student will compare the characteristics and uses for a variety of fuels and lubricants.

Learning Expectations:

The student will:

- | | | |
|-----|------------------------------------------------------|----------|
| 8.1 | Evaluate grades of diesel and their uses. | 1 |
| 8.2 | Evaluate gasoline octane ratings and purposes. | 1 |
| 8.3 | Evaluate lubricants, by service, grade and function. | 1 |

Evidence Standards is Met:

The student will:

- Select the correct diesel grade of fuel for agricultural equipment.
- Select the correct gasoline based on the recommended octane rating for agricultural equipment.
- Using manufacturer's recommendations, select a lubricant based on service and grade.

Integration Linkages

Mathematics, Science, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills), Small Engine Service Manuals, Agricultural Equipment Service Manuals

Sample Performance Tasks

- Compare additives used in different name brand oils.
- Compare additives used in different gasoline fuels.
- Compare additives used in different grades of diesel.
- Prepare a cost evaluation comparing the usage of different fuels and lubricants in farm machinery.

Standard 9.0

The student will demonstrate electrical motor operation, maintenance, and application.

Learning Expectations:

The student will:

- | | |
|-----|------------------------------------------------------------------------|
| 9.1 | Evaluate types of electric motors and their agricultural applications. |
| 9.2 | Analyze the basic parts of an electric motor. |
| 9.3 | Demonstrate the ability to wire an electric motor. |
| 9.4 | Specify the procedures for maintaining electric motors. |
| 9.5 | Evaluate control systems using electric motors. |

Evidence Standard is Met:

The student will:

- Recommend agricultural control systems using electric motors.
- Assess types of electric motors and their effectiveness in agricultural applications.
- Demonstrate the wiring of an electrical motor.

Integration/Linkages

Mathematics, Science, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Diagram parts of an electrical motor.
- Wire an electrical motor for an agricultural application.
- Design and implement an electrical control system for an agricultural application.

Standard 10.0

The student will evaluate career opportunities available in agriculture power and equipment.

Learning Expectations:

The student will:

- | | | |
|------|----------------------------------------------------------------------------------|----------|
| 10.1 | Evaluate careers and jobs associated with agricultural power. | 1 |
| 10.2 | Specify training and skills needed for careers in agricultural power industries. | 1 |

Evidence Standard is Met:

The student will:

- Select careers based on individual interests.
- Determine training needed for selected careers.

Integration Linkages

Labor Market Data for Tennessee, Language Arts, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Prepare a career interest list based around agriculture power.
- Prepare a career training plan for selected careers.

Standard 11.0

The student will integrate academic competencies in agricultural power and equipment.

Language Arts:

The student will:

- | | | |
|------|---------------------------------------------------------------------------------|----------|
| 11.1 | Use current resources to research modern improvements in agriculture mechanics. | 1 |
| 11.2 | Use appropriate grammar and spelling in filling out reports and forms. | 1 |

Mathematics:

The student will:

- | | | |
|------|--------------------------------------------------|----------|
| 11.3 | Convert English/metric ratios. | 1 |
| 11.4 | Read instruments in metric or English. | 1 |
| 11.5 | Use ratios and percentages in basic shop skills. | 1 |

Science:

The student will:

- | | | |
|------|--------------------------------------------------------|----------|
| 11.6 | Explain physical properties involved in combustion. | 1 |
| 11.7 | Explain basic hydraulic principles using Pascal's law. | 1 |
| 11.8 | Explain basic laws of electricity. | 1 |

Evidence Standard is Met:

The student will:

- Demonstrate the application of physical laws to the internal combustion engine.
- Complete applications and forms, using correct grammar, spelling and punctuation.
- Use mathematics to calculate measurements for repairs and maintenance.

Integration/Linkages

Language Arts, Mathematics, Science, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks

- Prepare a maintenance schedule, based on precision measurements and technical manual specifications.
- Complete industry applications and FFA award applications.
- Determine needed repairs from initial engine analysis.

Standard 12.0

The student will develop premier leadership and personal growth needed for success and advancement in the career area of agricultural mechanics.

Learning Expectations:

The student will:

- | | | |
|------|------------------------------------------------------------------------------------------|----------|
| 12.1 | Analyze careers in agricultural power and equipment. | 1 |
| 12.2 | Use FFA activities to develop leadership skills. | 1 |
| 12.3 | Develop a supervised agricultural experience program. | 1 |
| 12.4 | Demonstrate proficiency in agricultural mechanics through FFA career development events. | 1 |
| 12.5 | Prepare agricultural mechanic and power exhibits for displays. | |

Evidence Standard is Met:

The student will:

- Recommend careers in agricultural mechanics, based on personal interest and training needed.
- Prepare a resume for a career in agricultural mechanics.
- Complete records needed for a successful SAE program.
- Prepare for participation in the agricultural mechanics CDE, career development event.

Integration Linkages

Computer Applications, Language Arts, Public Speaking and Resume Writing, SCANS (Secretary's Commission on Achieving Necessary Skills), National FFA Guidelines for Agriculture Mechanics CDE, National FFA Guidelines for Proficiency Awards and Degrees, National FFA Community Education Programs

Sample Performance Tasks

- Prepare a resume for an agricultural career.
- Complete appropriate forms for a proficiency award.
- Complete appropriate forms for degree advancement in the FFA.
- Participate in FFA Agricultural Mechanics CDE.
- Complete an agricultural mechanics display for a fair, conference or show.
- Complete an application for employment.
- Participate in FFA PALS program.
- Participate in Food for America Program.
- Participate in FFA Partners for a Safer Community.
- Participate in Farm Safety Just 4 Kids.
- Participate in America Reads Challenge.